PATENT
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VACUUM ACTUATED DISPLAY ORNAMENTS

Background of the Invention

1. FIELD OF INVENTION.

This invention relates to display ornaments and, more specifically, to display ornaments which intimately adhere to surfaces, such as the glass surface of a bathroom mirror, through self-suction.

2. BRIEF DESCRIPTION OF PRIOR ART.

A multitude of adhesive display ornaments are provided to the general public for the purpose of advertising and promotion. Typically, an ornament is given to a customer, who in turn mounts the ornament to a convenient surface for future reference. However, once the ornament has been mounted several problems arise. The ornament itself may deteriorate or the message on the ornament becomes dated, creating the desire to remove the ornament. Removal of the ornament all too often leads to substrate damage from the adhesive used or an unsightly residue may remain.

In an effort to eliminate this problem, an alternative class of display ornaments, such as magnetic backed ornaments, has been created for temporary display of information without damaging the underlying substrate. For example, these ornaments enable one to temporarily display invaluable health-related information in a convenient location, such as the front panel of a refrigerator, for quick access during an emergency. However, such an ornament suffers the disadvantage of being limited to use on metal sub-

strates. We believe that a customized display ornament which affords one the opportunity to temporarily display information from a variety of locations, such as a bathroom mirror, a ceramic shower surround or the front panel of a refrigerator, would be a welcomed advancement to the art.

SUMMARY OF THE INVENTION

The present invention comprises an improved display ornament which adheres to substrates such as metal, plastic or glass, through self-suction. Said ornaments have predetermined shapes and are formed from a unitary or one-piece sheet of flexible material, preferably resinous thermoplastic material. Said shaped and flexible materials have a convex exterior surface and a concave interior surface, both of which are suitable for affixing a printed message. The interior surface of said ornament forms a concave cavity of measurable depth. Said cavity enables said ornament to adhere to surfaces when said cavity is compressed against a surface, which in turn creates an adhesive force through vacuum suction when said ornament flexes as it attempts to return to its original shape. The wall thickness of said ornament can be uniform but, preferably, the wall thickness varies, with the general area containing the center of mass (M) of said ornament being about 1/8" thick, and tapering to approximately 1/16" thick along its periphery. The periphery of said ornaments is custom shaped to meet the specific decorative requirement of the manufacturer.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a top perspective of the convex exterior surface of one embodiment of a display ornament in accordance with said invention.

Figure 2 is a cross-sectional view of one end of the display ornament along line 2-2 of Figures 1 and 5.

Figure 3 is a side perspective of said embodiment in a pre-compressed shape as viewed from the direction of line 3-3.

Figure 4 is a frontal perspective of said embodiment in a pre-compressed shape as viewed from the direction of line 4-4.

Figure 5 is a side perspective of said embodiment in a pre-compressed shape as viewed from the direction of line 2-2.

Figure 6 is a top perspective of the convex exterior surface of a symmetrical, rectangularly shaped display ornament.

Figure 7 is a side view of the ornament of Figure 6 when said ornament is resting on a substrate while in a "relaxed" shape.

Figure 8 is a side view of the ornament of Figure 6 when said ornament rests on a substrate when in a flattened, compressed shape.

Figure 9 is a top view of the convex exterior surface of an unsymmetrical, house-shaped display ornament.

Figure 10 is a side perspective of Figure 9 from the direction of line 3-3 of Figure 1 when said ornament is resting on a substrate while in a "relaxed" shape.

Figure 11 is a side perspective of Figure 9 from the direction of line 3-3 of Figure 1 when said ornament rests on a substrate when in a flattened, compressed shape.

Figure 12 is a top view of the convex exterior surface of an unsymmetrical, house shaped display ornament having a symmetrically shaped conical core.

Figure 13 is a side view of Figure 12 and said core when said ornament rests on a substrate when in a "relaxed" shape.

Figure 14 is a side view of Figure 12 and said core when said ornament rests on a substrate when in a flattened, compressed shape.

Figures 15 to 18 depict various embodiments of display ornaments made in accordance with said invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to Figures 1 to 5, one embodiment of a display ornament, made in accordance with the invention, comprises simply a unitary, flexible sheet of material which forms a predetermined shape of a house. Said ornament has a convex exterior surface 1 and a concave interior surface 2, both of which are suitable for affixing a printed message. The interior surface of said ornament forms a concave cavity 3 of measurable depth as illustrated in Figure 2. Periphery 4 of said ornament is custom shaped, for example, to form the shape of a house, to suit the design requirements of the manufacturer.

Interior concave cavity 3 of said ornament can be seen in Figures 10 and 11. The interior concave cavity of said ornament

enables adhesion to surfaces by generating a vacuum suction when said ornament is in a flattened, compressed shape as illustrated in Figure 11. When in said compressed shape, periphery 4 of said ornament rests snugly against substrate 5 so as to form a continuous seal. Said seal maintains the vacuum suction force generated within the interior concave cavity of said ornament. It should be noted that, depending on the selected embodiment of said ornament, beveled periphery 4 does not necessarily lie continuously flush against substrate 5 when in a pre-compressed shape as illustrated in Figure 10. However, when compressed, said periphery in turn properly mates against substrate 5 to form a continuous seal, thereby enabling attachment to said substrate.

The shape of said display ornament is preferably molded from a flexible sheet of thermoplastic resinous material such as vinyls, e.g., polyvinyl chloride. The wall thickness of said ornament can be uniform, in the case of symmetrical shapes, but for non-symmetrical shapes, the wall thickness must vary with the general area containing the center of mass M of said ornament being, for example, about 1/8" thick for polyvinyl chloride, and tapering to approximately 1/16" thick along periphery 4 when the object has a surface area of about 5 square inches; that is, taper is 50%. Tapering the wall thickness is required when constructing irregular and/or unsymmetrically shaped display ornaments.

Referring to Figures 6 to 8, we have found that when a symmetrically shaped ornament having uniform wall thickness, such as

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a rectangular shaped ornament, is compressed, then an upward/ outward flexural force 16 is generated which, in turn, generates horizontal, frictional force 17 as said ornament flexes in an effort to return to its original pre-compressed shape. It is believed said force is uniformly distributed throughout the periphery of said ornament, and can be equally divided into two parts by a plane of symmetry which bisects said ornament. The magnitude of said force is directed along said plane of symmetry and perpendicular to horizontal plane 15 on which said ornament rests as illustrated in Figure 8. As a result, adhesion to horizontal plane 15 is achieved, since the uniformly distributed force in turn causes an even vacuum seal to be formed along periphery 14 of said symmetrical ornament. However, a plane of symmetry does not exist in the case of irregular or unsymmetrically shaped display ornaments as illustrated in Figure 9. Therefore, when an unsymmetrically shaped display ornament, having uniform wall thickness, is compressed and attempts to "flex" back into its original pre-compressed shape, then an irregular flexural force 6 is generated. Consequently, an irregular horizontal, frictional force 7 is generated in reference to a plane which attempts to bisect said ornament as well. As a result, adhesion to surfaces is adversely affected, since portions of periphery 4 are subjected to varying degrees of force, thereby enabling portions of said periphery to pull away from the surface of attachment and releasing the vacuum seal formed along periphery 4 as illustrated in Figure 10.

We have found that this problem can be overcome by molding the curved body of said ornament in a manner whereby the wall thickness of the central portion of said ornament tapers by 50% (for shapes having surface areas from 3 in^2 to 25 in^2). This forms a symmetrically shaped core about the general area encompassing center of mass M of said ornament as illustrated in Figures 12 to 14. Said core is particularly of value because it provides a localized region within said irregularly or unsymmetrically shaped ornament which itself is symmetrical in reference to an axis of rotation located at center of Mass M of said ornament.

Referring to Figures 13 and 14, we have discovered that said region helps stabilize the irregular flexural properties associated with irregularly or unsymmetrically shaped ornaments by generating a flexural force 8 which is itself uniformly distributed and concentrated throughout the central cavity area of said ornament. Therefore, the primary function of said core is to provide a secondary flexural force of magnitude capable of compensating for the irregular flexural force associated with the overall irregular shape of said ornament.

Preferably, said core is conical shaped. It is believed an unlimited combination of cavity dimensions exists, such as base width and cavity depth, which will enable said core to generate a flexural force capable of offsetting said irregular flexural forces. For example, we have found that the overall area of, and weight contained within, a conical shaped core can vary greatly

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depending on the material used to construct said ornament and the selected embodiment of the invention. For example, when using polyvinyl chloride to construct an ornament similar to the embodiment illustrated in Figure 12, it is discovered that the core occupies approximately 57% of the total area of said ornament, and at least 75% of the overall weight of said ornament is contained within said core. Whereas, when molding the embodiment illustrated in Figure 15, it is found that a conical shaped core is formed such that it occupies at least 42% of the total area of said ornament, and contains at least 50% of the overall weight of said ornament. Preferably, the overall area of said ornament is from about 3 square inches to about 25 square inches, and the depth of interior concave cavity 3 at the center of mass M is at least about 1/2", given the above described features of said conical core.

The periphery of the display ornament is custom shaped so as to provide the manufacturer with a degree of flexibility in meeting their design requirements. For example, Figure 15 depicts a display ornament customized for display in a local pet shop. Figure 17 is illustrative of a display ornament having customized shape in the form of a tooth for display in a dental office, whereas said ornament might be shaped in the form of an apple when addressing the display objective of a local produce store as illustrated in Figure 18.

We have identified a number of manufacturing processes which can be utilized to mold the curved body of said display ornament.

One useful method is injection molding. When injection molding said ornament, it is believed an extreme amount of pressure is applied to force a pelletized form of the material, such as vinyls, into a cavity heated to a specified temperature. Once the material has filled the cavity and the desired shape formed, the part is then ejected from the cavity, allowed to cool and the cycle repeated.

The curved body of said injection molded ornament can be utilized to conveniently display information. For example, information can be displayed by directly printing, such as silk-screening, pad printing, etc., on the surface of said ornament. Another method would be to affix a label to the curved body of said ornament. A label can be affixed to said body by using an adhesive, or some other mechanism, such as heat. Preferably, heat is applied to affix said label to said body by using a process commonly referred to as In Mold Labeling. In Mold Labeling is a process whereby a label is mechanically inserted into the cavity of an injection molding tool at some point during the injection molding phase of said ornament. Said inserted label is therefore directly molded into the body of said ornament. It is believed that In Mold Labeling is a cost efficient method of affixing information to said ornament because it allows one to both mold and affix information to said ornament in one step.

Another method of molding the curved body of said ornament is to die cut said ornament from a flat, flexible sheet of

material, and then molding the die cut piece into the desired conical shaped ornament. It is believed said method entails the preprinting of a specified number of the desired shape and related information onto a flat sheet of flexible material. Preferably, each shape is then die cut from the flat sheet by using two heated surfaces which mate. One of the mated surfaces should serve to impart a convex shape to the exterior portion of said ornament, while the other imparts a concave shape to the interior surface of said ornament. The primary function of the heated surfaces is to facilitate molding of the flat, die cut pieces into the desired conical shape. Secondly, it is preferred said surface or surfaces provide a means for cutting said pieces from said flat sheet of flexible material when said surfaces press against said flat material.

It is believed some type of mechanical means, such as an air actuated mechanism, should be utilized to hold the flat, die cut pieces in place between said mated surfaces. Said air actuated feature would ensure said pieces are properly oriented and firmly held in place against said surfaces until the applied heat has molded said pieces into the desired conical shaped ornament.

It is believed this method of molding said ornament is more valuable than injection molding, because it dramatically reduces the time required to print on said ornament. Secondly, this method makes it possible for a manufacturer to conveniently store numerous flat sheets of said printed ornaments until said ornaments are to be molded into finished, conical shaped ornaments.

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This, in turn, reduces the inventory space required to store said premolded pieces until the subsequent molding process is utilized to convert said flat sheets into finished, molded ornaments.

We have identified some additional beneficial characteristics of the material utilized to mold the curved body of said ornament. Preferably, said flexible material has a degree of tackiness. Said feature is believed to enhance the vacuum adhesive properties of said ornament by improving the vacuum seal formed along said periphery. Secondly, it is desired that said material has a degree of friction generating capabilities. It is believed said property is useful because it will impede the tendency of said compressed ornament to flex out of said shape and slide over a surface of attachment. Therefore, the purpose of said frictional property is to increase the energy barrier required to overcome the adhesive suction force generated when said ornament is compressed.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and the appended claims.

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